

RP 812 Wind Turbine Main Bearing Grease Sampling Procedures

The following recommended practice (RP) is subject to the disclaimer at the front of this manual. It is important that users read the disclaimer before considering adoption of any portion of this recommended practice.

This recommended practice was prepared by a committee of the AWEA Operations and Maintenance (O&M) Committee.

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Purpose and Scope

The scope of “Wind Turbine Main Bearing Grease Sampling Procedures” discusses the methods for taking uncontaminated and trend-able grease samples from wind turbine main bearings. Samples that are taken properly can provide the user with accurate data for maintenance decision making.

The general procedure applies to wind turbine lubrication systems. There are several different wind turbine main bearing types. This paper will focus on two common main bearing types: those with drain purge plugs and those without. Following methods laid out in ASTM D7718, “*Standard Practice for Obtaining In-Service Samples of Lubricating Grease*”. These recommendations will give proper procedures for the handling of sampling devices and grease before and after samples have been taken to ensure that data obtained from grease analysis is accurate.

Introduction

Performing grease analysis from a specific sampling location is important in ensuring repeatability and accuracy. Unlike oil samples, which can more thoroughly mix and circulate through a gearbox or other location, greases are semi-solids and their flow behavior is quite different. Known as a “non-Newtonian” fluid, their movement and circulation in a bearing is dependent on the grease consistency, temperature, and force applied by nearby moving components, among other factors.

Introduction (continued)

Published studies demonstrate that greases in wind turbine main bearings do indeed move and circulate, but only in an area very close to the moving parts of the bearing. Therefore, it is critical that any sampling methods provide effective means to obtain grease close to these moving zones or otherwise ensure that grease samples are not compromised by contaminating or diluting influences as they travel away from these flow zones. The methods outlined in this recommended practice provide several approaches to achieve this goal.

Wind Turbine Main Bearing Grease Sampling Procedures

1. Main Bearing Grease Sampling Procedures with Drain Access Plug

NOTE: In this section, “grease sampler” refers to the “passive grease sampling device” described in ASTM D 7718, Section 8. The “T-handle” describes a tool used to reach the grease sampler into the bearing and actuate the sampler at the proper point in the machine. This method ensures that the sample obtained is taken from the area of the bearing where grease circulates due to the action of the bearing.

- 1.1. Place a catch basin below the drain plug to catch any dripping grease.
- 1.2. Remove the drain plug, clean it, and set in a safe place for later re-insertion.
- 1.3. If necessary, remove the grease sampler from packaging used to keep it clean until ready for use. Ensure that the open end of the grease sampler is clear of any cap and that the internal piston is positioned to close off the sampling tube.
- 1.4. Attach the grease sampler piston handle to the T-handle tool by inserting the end of the handle into the internal rod.



Figure A

- 1.5. Insert the internal rod into the pusher tube with the grease sampler facing forward. (See *Figure A*)

1.6. Thread the base of the grease sampler into the female threads in the pusher tube and make adjustments to set the depth at which the sample will be taken. This should be made based on a measurement or print of the bearing and set such that the fully extended position of the sampler will be very close to, but not touching, the face of the bearing rolling elements.



Figure B

1.7. Position the pusher tube so that the internal piston is flush with the end of the grease sampler. (See *Figure B*)

1.8. Fully insert the grease sampler and T-handle into the drain hole until the positioning guides of the T-handle contact the bearing housing face, positively positioning the grease sampler at the desired set depth.

1.9. Slide the pusher tube forward, while holding the T-handle firmly against the housing face, to core a grease sample close to the bearing.

1.10. When the pusher rod has been slid completely forward, hold it in that position as the T-handle and grease sampler are withdrawn from the housing and access hole.

1.11. Using a clean rag, wipe the excess grease from the T-handle parts and the OUTSIDE of the grease sampler body, being careful not to contact the grease inside.

1.12. Release the internal rod so that it spins freely and un-thread the grease sampler from the pusher tube.

1.13. If there is insufficient grease to sample using the T-handle, utilize a disposable spatula to gather grease from within the drain area and pack into the opened syringe. The syringe is opened by removing the plunger.

The grease selected in this manner should, wherever possible, be taken from the far end of the access hole. If necessary, drag out most of the grease in the hole and set aside to access the grease closest to the moving parts of the bearing.



Figure C

1.14. Additional grease can be put into the grease sampler by reinserting the plunger in the syringe and pushing grease into the grease sampler to achieve maximum fill. (See *Figure C*)

1.15. The open end of the grease sampler should be secured by placing a cap over the end prior to shipment. It may be necessary to purge a small portion of the grease from the sampler into the cap to avoid an air pocket being pushed into the sampler, displacing some of the sample through the far end of the sampler.

1.16. Once a small portion of the grease is in the cap, slide the cap on the grease sampler just far enough to engage the end of the sampler as a friction fit.

1.17. Place the filled and capped grease sampler into a suitable shipping tube to prevent leakage from the grease sampler and protect it during shipping.

1.18. Affix a sample label on the shipping tube, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler's name, and any notes or observations for the lab. Ensure all samples are clearly identified and promptly submitted to the lab for analysis.

2. Main Bearing Grease Sampling Procedures With Drain Access Plug: Alternative Method

NOTE: This method follows guidance provided in ASTM D7718, Section 10.

2.1. Remove the drain plug and allow any grease near the plug to drain out.

2.2. Using a clean spatula or straw, remove all grease from the inside of the drain area up to a point within about 1" of the moving parts of the bearing. Ensure that in this purging step a sufficient amount of grease remains to obtain the required sample amount.

2.3. Utilize a new, clean spatula or straw to gather grease from that area directly adjacent to the moving bearing parts and pack into an opened syringe. The syringe is opened by removing the plunger. In place of a syringe, a similar suitably clean, closeable container can be used to gather the sample. If the analysis to be performed is a small-volume method as outlined in RP-814, it may be necessary to use the syringe to inject grease into the “passive grease sampling device” described in ASTM D7718. Instructions for properly filling that device are described in the previous section, Steps 1.14 through 1.17.

2.4. Affix a sample label on the sample container, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler’s name, and any notes or observations for the lab.

2.5. Place the sampling container inside the shipping envelope or box and promptly send to the lab for analysis.

3. Main Bearing Grease Sampling Procedures without Drain Access Plug

NOTE: Some bearings do not have a drain access plug or this plug does not provide sufficient access to grease close to the bearing moving parts. In those cases, grease may need to be taken from the face of the bearing, where excess grease is purged in the natural course of the addition of new grease. Samples taken in this manner are much less protected from environmental contaminants, which can skew results. Effort is required to ensure that the influence of these external contaminants are kept to a minimum, and analysis of these samples should consider the potential influence of these factors when making evaluation and recommendations.

3.1. Obtain a disposable spatula or straw that will allow both movement and displacement of external contaminated grease and capturing of the protected underlying grease closer to the exit area. Opposing ends of this straw or spatula can be designated for these two purposes. A syringe or suitable container should be available to place the sampled grease and these sampling devices should be kept clean in protective packaging up to the time of sampling.

3.2. Using a clean rag, wipe the excess grease from the face of the bearing, being careful not to wipe away representative grease just exiting the bearing.

- 3.3.** Select an accessible location on the face of the bearing, close to the bottom of the bearing roller travel, and near the shield gap where excess grease exits the bearing. (See *Figure D*)



Figure D

- 3.4.** Open the protective packaging and remove the disposable spatula/straw and sample container. Using one end of the spatula/straw, wipe away the outermost grease in the area to be sampled to remove ambient dirt and expose underlying recently purged grease.
- 3.5.** Turn the spatula/straw around, utilize the other end to gather grease exiting the bearing face, and pack into the sampling container. If a syringe is used, it is opened by removing the plunger.
- 3.6.** If the analysis to be performed is a small-volume method as outlined in RP-814, it may be necessary to use the syringe to inject grease into the “passive grease sampling device” described in ASTM D7718. Instructions for properly filling that device are described in the first section, Steps 1.14 through 1.17.
- 3.7.** Affix a sample label on the sample container, filling out all necessary information clearly and legibly, including equipment identification, sample date and time, sampler’s name, and any notes or observations for the lab.
- 3.8.** Place the sampling container inside the shipping envelope or box and promptly send to the lab for analysis.

Summary

Proper grease sampling methods are crucial for comparing samples from one turbine to another or for trending samples from the same turbine. If the proper methods are not employed, grease samples can be obtained that do not represent the condition of the bearing wear, contamination levels, or the physical properties of the grease actively involved in lubricating the bearing. Any analysis from such inadequate samples will be misleading and result in improper maintenance actions being taken. Properly obtained samples ensure that analysis results represent current bearing conditions and provide the basis for sound maintenance decisions to provide reliable main bearing operation.